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HEN HOUSE TRACKING CAPABILITY AGAINST

NON-COOPERATIVE SATELLITES

The network of Hen House radars now approaching completion will
give the Soviets a formidable capability to track non-cooperative
(those without transponders) space objects. Sixteen Hen Houses in
the southern USSR--eight at Angarsk and eight at Sary Shagan--appear
to be deployed primarily for space tracking. The two Hen Houses at
Olenegorsk and two at Skrunda in the north probably have a primary
mission of ICBM early warning and tracking, but they are capable of
providing valuable data in a space-track network.

One dual Hen House at each of the two southern locations has been
detected during early test transmissions. At both Angarsk and Sary
Shagan, another dual Hen House, facing in the opposite direction from
the first-completed radars, is almost complete. In addition, two
more Hen Houses of a markedly different external appearance--the
so-called "fat boy" configuration--are in the early to middle stages
of construction at each southern cluster.

The initial signals intercepted from the primary space-track Hen
Houses closely followed the characteristics of B357Z, the signal used

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by the research and development (R&D) radar until early 1965. The one

signal intercept so far received from the Olenegorsk dual Hen House

was of the T5136 format, which has been used by the R&D Hen House

since early 1965. The greater power and additional complexity of the

T5136 signal are necessary for effective ABM early warning and

tracking, but would not be required for tracking relatively large-

sized space objects in low-altitude orbits. The B357Z format would

be perfectly adequate for these latter targets. Both signals have been

detected steadily tracking small satellites (1-10 m^2 cross section) at

ranges up to 1000 nm.

A comparison of the two Hen House signal formats is shown in

Table 1. Maximum performance of the two signals is compared in

Table 2. In addition to the Hen House network, a very large facility,

the Dog House, is being constructed at Naro-Fominsk near Moscow.

It appears to be a bi-static, phased-array radar system. Both North-

west (328°) and Southeast (148°) faces are being completed. Though

this radar is believed to be a part of the Moscow ABM system, its

location and the boresights of its two faces are such as to close the

network formed by the Hen House radars. No Elint has been received

from the Dog House and its characteristics are unknown but its

tracking capability will probably be somewhat better than that of the

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Hen Houses.

The locations of the Hen House and Dog House radars give them an excellent opportunity to view any orbiting object in near-earth space, so long as the orbit inclination is high enough to carry the object over the Soviet Union. Such visibility provides the Soviets with a vastly improved capability to track both passive Soviet objects in orbit and non-Soviet satellites. Space surveillance of this sort had previously been forced to rely upon optical tracking networks. Table 3, based on a 100 nm circular orbit, shows, as an example, periods of visibility to the individual Hen Houses for a variety of inclinations.

In order to determine accurately the trajectory of an unidentified object, the Hen Houses would need to obtain two separate looks at the object, the period of the orbit cannot be determined well during the short time available from just one look. A measure, therefore, of the time required to obtain good knowledge of orbital parameters is simply the time required for two separate Hen House tracking passes. Table 3 lists, for various inclinations, the number of orbits after launch (from Vandenberg AFB) required before the full Hen House network could predict the satellite's position one orbit ahead to an accuracy of better than 3 nm. The tracking accuracy on

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which this table is based assumes the Hen House to be in a track-while-scan mode with the following one-sigma single-measurement accuracies:

Range   2500 ft

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Range Rate   no capability

These accuracies are less than the thermal-noise-limited accuracies of Table 1, but are considered conservative estimates of the radar's overall system capability in the presence of all degrading influences, such as propagation path effects.

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